

# MEMO

**TO:** Tom Peterson, CSI LEED AP, Peterson Consulting, Inc.

**FROM:** Corey Mack, PE

**DATE:** July 2, 2020

**SUBJECT:** BHS Campus Plan – Revised Traffic Assessment and Review

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The Burlington School District requested RSG to update their analysis of estimated traffic associated with the proposed Burlington High School (BHS) Campus Redesign. This memorandum documents the proposed changes to vehicle access patterns, estimates the associated traffic congestion with the revised vehicle traffic patterns, and recommends potential site and traffic engineering improvements to reduce vehicle conflict, increase safety, and minimize congestion during the dismissal period.

The traffic assessment is based on the overall site plan provided by Wagner Hodgson Landscape Architecture dated June 8, 2020.

## 1.0 REVISED SITE PLAN

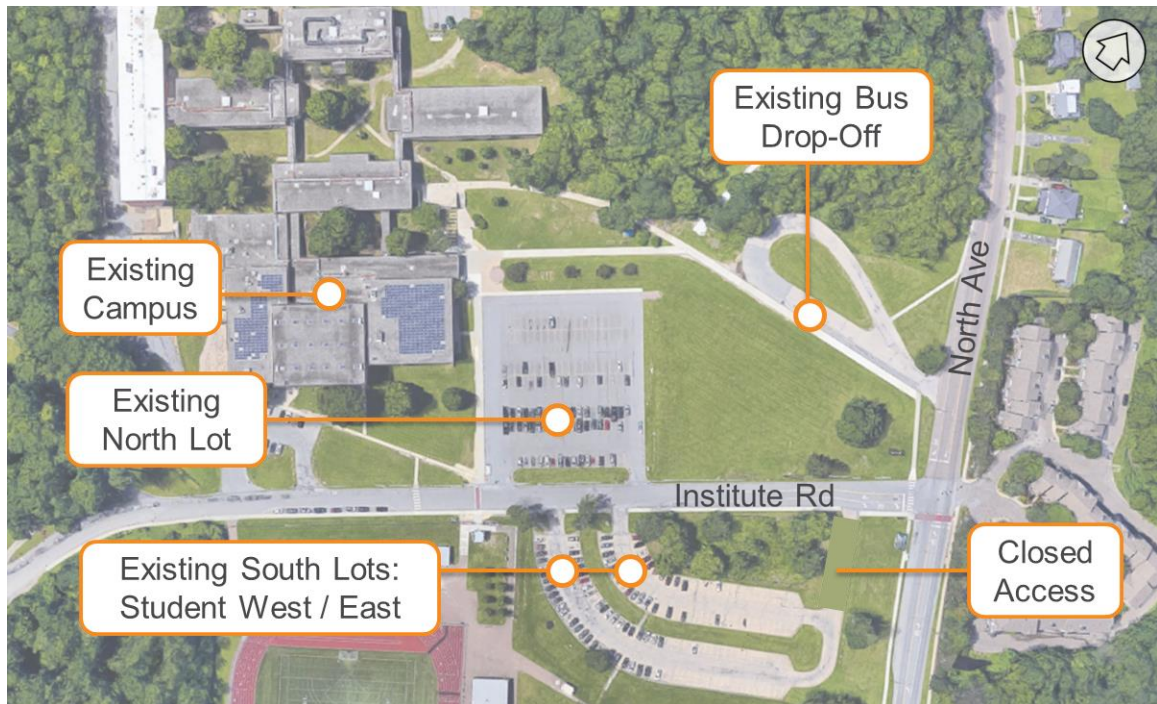
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The existing BHS campus is shown in Figure 1, and the revised overall site plan is shown in Figure 2. The primary change to vehicle access is associated with the existing north lot (ENL). The ENL consists of 122 parking spaces, and a curb-side aisle used as approximately 30 temporary pick-up and drop-off spaces. The proposed north lot (PNL), illustrated in the revised site plan, formalizes circulation aisles, creates a centralized school entrance, and levels the parking surface for accessibility. The PNL will include 105 parking spaces and a curb-side aisle for 16 temporary pick-up and drop-off spaces. The number parking spaces, and their specific assigned use, is documented in Table 1.

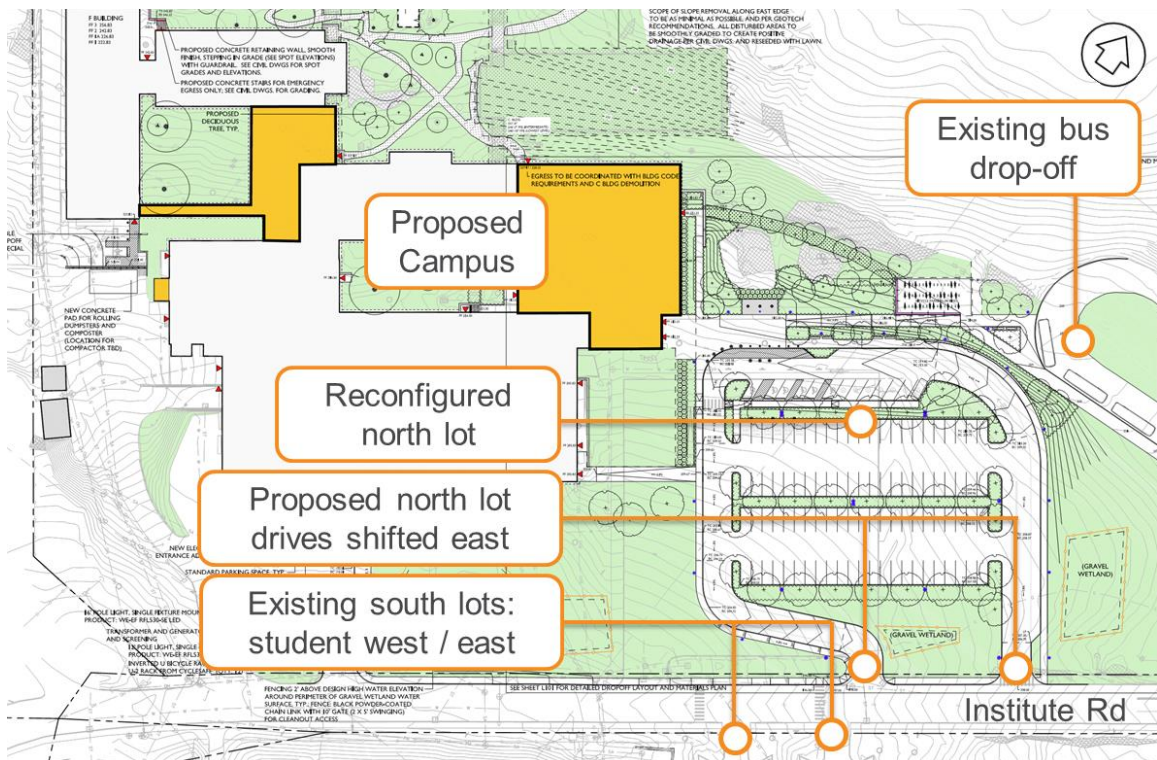
Compared to the previous campus design presented in earlier traffic assessment, the layout of the revised PNL will operate much more similarly to the existing conditions. Buses will remain on a separate loop directly off North Avenue. Personal vehicles will access the campus from Institute Road. The existing one-way circulation pattern is recommended to remain.

Both the entrance and exit drives to the north lot will shift east along Institute Road. The proposed eastern entrance drive is approximately 240-feet west of North Avenue (the existing drive is approximately 370-feet west of North Avenue, and the previous design drive was approximately 260-feet west of North Avenue), and the proposed western exit drive is approximately across from the south lot east drive.

**FIGURE 1: EXISTING BHS CAMPUS**



**FIGURE 2: PROPOSED BHS CAMPUS (REVISION DATE 6/8/20)**





**TABLE 1: EXISTING AND PROPOSED NORTH LOT PARKING SPACES**

PARKING SPACE TYPE	EXISTING NORTH LOT	PROPOSED NORTH LOT
General Purpose	103	92
Accessible	4	6
Visitor / Short Term	15	7
Parallel Short Term	30	16
Total Parking Spaces	152	121

The school district is not anticipating any changes to overall total student enrollment or employment as a result of the school campus renovation project. The school district is intending to assign 16 existing parking spaces in the rear, wrap around parking area nearest the Burlington Technical Center (BTC) to facility management fleet vehicles. The displaced employees who currently park in these locations are expected to instead park in the overflow south lots as needed.

General school operating hours are not expected to change. These hours are:

Staff Arrival	7:45
Student Arrival	8:00 – BHS; 9:35 – BTC
Student Dismissal	3:05 – BHS; 2:21 – BTC
Staff Departure	3:30

## 2.0 UPDATED TRAFFIC ANALYSIS

The traffic analysis relies upon trip generation estimates and procedures outlined in the previous memorandum, dated 7/18/19. Please refer to the previous memorandum for details documenting traffic volumes, estimated traffic demand, development of 5-minute peak hour factor (PHF-5) adjusted analysis volumes, and queueing observations.

### 2.1 DISMISSAL PERIOD

In the previous traffic analysis, RSG estimated traffic demand during the dismissal period to be proportional to the increase in visitor / short term spaces. This updated design results in a decrease in visitor / short term spaces. Rather than apply a proportional reduction in traffic demand associated with the change in visitor / short term spaces, this revised traffic analysis assumes the traffic demand will remain unchanged from the existing observations. The existing PHF-5 analysis volumes are presented in the following figures.

**School Departure Traffic Volume Existing Raw**

**Existing Burlington High School Campus**

The diagram illustrates the existing traffic volumes at the Burlington High School campus. It features a central horizontal corridor with several intersections. From left to right, the intersections are: Institute Rd (with a 'Bus Drop' area), a 'ONE WAY' street crossing, and North Ave. The corridor is flanked by various areas: 'Technical Center / ADA Access' and 'Athletic Fields' on the left, and 'Existing North Lot West', 'Existing North Lot East', and 'City Bluffs' on the right. Traffic volumes are indicated by numbers and arrows showing the direction of flow. A north arrow is located in the top right corner.

Location	Volume
Institute Rd (Left)	1, 22, 0
Technical Center / ADA Access	2, 1, 51
Athletic Fields	0, 0, 2
Existing North Lot West	3, 127
Existing North Lot East	3, 229, 0
City Bluffs	3, 0, 1

**Proposed Burlington High School Campus**

The diagram illustrates the proposed traffic volumes at the Burlington High School campus. It features a central horizontal corridor with several intersections. From left to right, the intersections are: Institute Rd (with a 'Bus Drop' area), a 'ONE WAY' street crossing, and North Ave. The corridor is flanked by various areas: 'Technical Center / ADA Access' and 'Athletic Fields' on the left, and 'Proposed North Lot West', 'Proposed North Lot East', and 'City Bluffs' on the right. Traffic volumes are indicated by numbers and arrows showing the direction of flow. A north arrow is located in the top right corner.

Location	Volume
Institute Rd (Left)	1, 22, 0
Technical Center / ADA Access	2, 1, 51
Athletic Fields	0, 0, 2
Proposed North Lot West	3, 127
Proposed North Lot East	3, 247, 0
City Bluffs	3, 0, 1

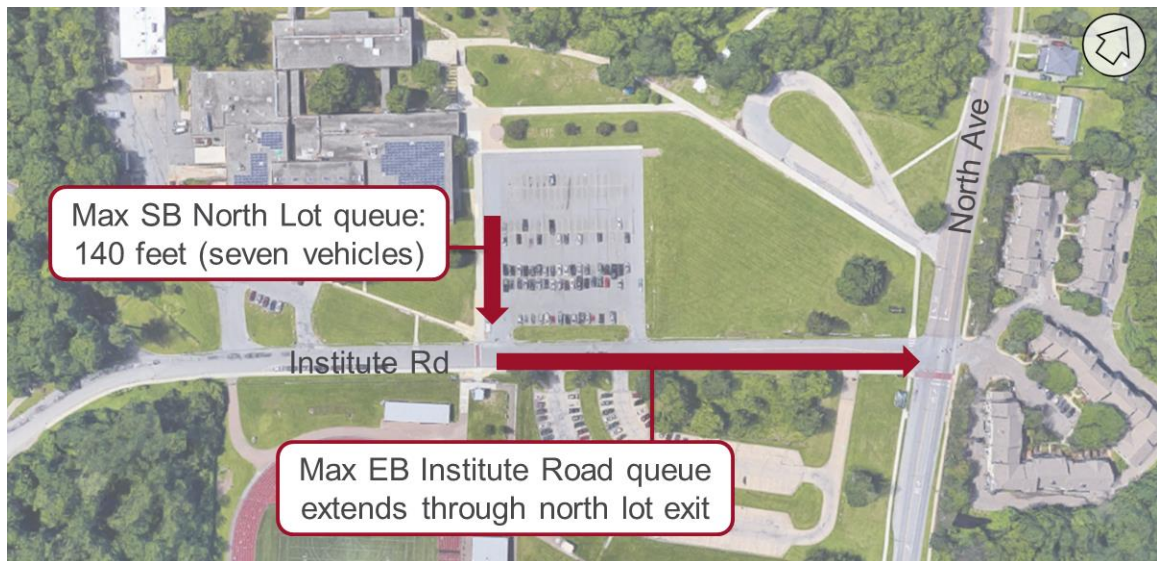




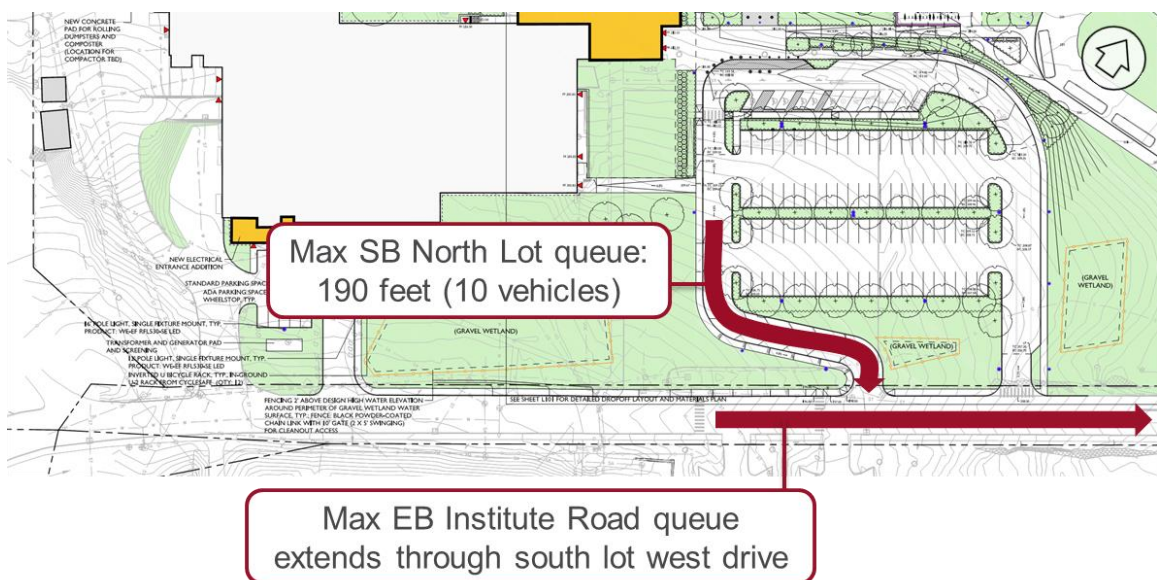
With little change in traffic volumes between existing conditions and proposed conditions, we do not expect to see any significant change in conventional traffic analysis metrics such as delay, level of service, or volume-to-capacity ratio between the No-Build (existing condition) and Build (proposed condition) scenarios.

The layout and spacing of driveways do impact queue development. Queue interaction and spillback can be modeled with SimTraffic microsimulation software. The existing conditions modeling remains unchanged from the previous analysis and is reproduced in the following figure.

**FIGURE 4: MAXIMUM QUEUES FROM SIMTRAFFIC MODEL ALONG EB INSTITUTE ROAD AND SB EXISTING NORTH LOT EXIT**



**FIGURE 5: MAXIMUM QUEUES FROM SIMTRAFFIC MODEL ALONG EB INSTITUTE ROAD AND SB PROPOSED NORTH LOT EXIT**



As discussed in the previous analysis, the queues modeled are unlikely, and would only approach that length for one or two cycles during the peak 10-minute dismissal period from 3:05 to 3:15. Outside of this period, traffic volumes are lower and congestion is not an issue.

## **2.2 ARRIVAL PERIOD**

RSG did not observe the arrival period or capture or process data during the morning peak period at the existing BHS campus. However, it is our experience that student arrival patterns typically exhibit a wider time distribution due to morning activities at the school. A recent analysis of the Winooski School District (WSD) campus travel patterns indicated that drop-offs significantly increased approximately 20 minutes prior to the start of school, with peak drop-offs in final five minutes prior to the start of school. The peak 5-minute arrival period drop-off demand, measured by departures from the school campus in the morning peak, was approximately 56% of the peak 5-minute dismissal period departure demand.

The peak 5-minute dismissal period departure demand at the BHS campus is 62 vehicles, from 3:10 to 3:15. Assuming the same ratio of arrival period drop-off demand to dismissal period departure volume as seen at the WSD campus, the peak BHS drop-off demand is 35 vehicles in 5 minutes, or seven vehicles per minute. Assuming a dwell period of 2 minute for a vehicle to pull over, unload students, and re-enter traffic, the campus would require a drop off capacity of 14 spaces; the PNL proposes an aisle of 16 short-term pick-up and drop-off parallel spaces. The revised layout of the proposed north lot is expected to accommodate peak arrival period drop-off demand.

In the event that peak arrival period drop-off demand exceeds the proposed capacity, queuing is not expected to spill back onto Institute Road or North Avenue. The width of the outer PNL circulation aisle is between 24-feet and 18-feet. While not advised or encouraged, this width should allow circulating traffic to pass double parked or improperly parked vehicles.

## **3.0 SITE PLAN REVIEW AND RECOMMENDATIONS**

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Recommendations and observations resulting from our review of the revised site plan are illustrated in Figure 6.

### **3.1 RECOMMEND ONE WAY CIRCULATION FLOW IN PNL**

The eastern entrance drive to the proposed north lot is illustrated in the site plan with a double yellow line. We recommend instituting a one-way circulation pattern to simplify access patterns and reduce the number of vehicle conflict points.



### **3.2 EXPECT DRIVERS TO USE THE ENTIRE LENGTH OF OUTER CURB DURING THE PICK-UP AND DROP-OFF PERIODS**

There is a dedicated parallel pick-up and drop off aisle on the eastern and northern curb lines of the PNL. However, many drivers will ignore open spaces early in the access aisle in order to drop off closer to the entrance or will prefer to queue in the dismissal period at a location to be “first in line” to depart. We would expect many drivers to use the hatched area in the front of the school for morning drop-off, and the western curb line for both morning overflow drop-off and afternoon pick-up standing and queuing.

The PNL circulating aisle width is at least 18-feet; most vehicles would still be able to pass an improperly parked and standing vehicle.

### **3.3 RECOMMEND ALIGNING THE PNL EXIT AND EAST SOUTH LOT DRIVES**

We recommend aligning the PNL exit drive to be directly across from the south lot east drive. Removing the offset to the intersection and allow for clearer vehicle interactions between northbound and southbound approaching vehicles. This may increase the grade of the southbound approach drive above 5%, which would require a handrail. A handrail, while an additional expense, may be advantageous to help keep pedestrians on the walkway rather than walking on the planted slope to reach the south parking lots in the shortest line.

### **3.4 RECOMMEND MODIFICATIONS ON INSTITUTE ROAD**

A short, 90-foot parallel parking aisle is present on the south side of Institute Road, between North Avenue and the existing north lot entrance drive. This parallel parking aisle has capacity for four to five vehicles. During review of the videos of the dismissal period on May 16, 2019, we did not observe any vehicles parked in this parallel parking aisle. We did observe vehicles bypassing the left turn lane queue by driving through the parallel parking aisle. School staff anecdotally noted that these spaces are rarely used except during athletic events or the summer for North Beach parking

The revised site plan did not illustrate any striping at this location. We recommend the striping, parking aisle, and lane designation is clarified through this area. Potential improvements along this location may include:

- Removal of the parking aisle to reduce potential conflicts at the Institute Road / PNL entrance drive intersection.
- Clarification of the EB Institute Road approach lanes, which may include:
  - Extension of the turn lane lines
  - Installation of a lane designation sign
  - Installation of bulb outs on the south side of Institute Road to reinforce the one-lane drive aisle and reduce the pedestrian crossing distance.



Additionally, the bulb out areas may provide opportunities for stormwater infiltration and / or treatment.

### 3.5 RECOMMEND MODIFIED SIGNAL TIMING ON NORTH AVENUE

We recommend working with the City of Burlington's Department of Public Works to implement a dismissal period signal timing plan to be in effect from 3:05 to 3:20. This timing plan could assign a greater percentage of green to Institute Road and / or shorter overall cycle lengths to reduce the queue development along Institute Road. This targeted signal retiming would result in minor increased delay to North Avenue for a short period of time in a non-peak period and only when school is in session.

**FIGURE 6: CONCEPT SKETCH OF RECOMMENDATIONS RESULTING FROM REVIEW OF 6/8/20 BHS SITE PLAN**

